



Preliminary Findings Describing Participant Experience With iSTEP, an mHealth Intervention to Increase Physical Activity and Improve Neurocognitive Function in People Living With HIV

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We assessed the feasibility and acceptability of using text messages to monitor and encourage physical activity in the first 21 participants enrolled in an ongoing randomized controlled trial evaluating a 16-week Short Message Service/Multimedia Message Service (SMS/MMS) intervention (iSTEP) designed to increase moderate physical activity and improve neurocognition in persons with HIV-associated neurocognitive disorders (HAND; iSTEP, n = 11; control group, n = 10). Data were collected during the intervention and from interviews conducted at the 16-week postintervention visits. Text message response rates for both iSTEP and control participants were high (89% and 85%, respectively). Pedometer self-monitoring, step count goals, and milestone achievement texts were reported to facilitate physical activity. All iSTEP participants (100%) and 70% of control participants indicated that they would recommend the study to other people living with HIV. The results indicate that it is feasible to administer an SMS/MMS physical activity intervention to persons with HAND.

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Approximately 30–60% of people living with HIV infection (PLWH) manifest some form of neurocognitive impairment, including deficits in executive function, attention, and memory collectively referred to as HIV-associated neurocognitive disorders (HAND; Antinori et al., 2007). HAND includes three categories: asymptomatic neurocognitive impairment (ANI), HIV-associated mild neurocognitive disorder (MND) defined by self-reported deficits in everyday functioning, and HIV-associated dementia (HAD; Antinori et al., 2007). HAD has declined in the combined antiretroviral treatment era, but ANI and MND, characterized by impaired performance in at least 2 cognitive domains, remain prevalent and occur in approximately 40% of PLWH (Heaton et al., 2010). Individuals with ANI do not self-report everyday functioning deficits, but they can exhibit functional impairment on objective performance-based tests (Blackstone et al., 2012b). Although less severe than HAD, mild to moderate neurocognitive impairment in ANI and MND represents a significant public health challenge and is associated with higher

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mortality, disruption in daily living, high risk of more significant cognitive decline, and poor quality of life (Moore et al., 2014). Despite the pervasive presence of HAND, few studies have examined ways to treat neurocognitive deficits or established evidence-based procedures for rehabilitation. Consequently, there is a significant unmet need to establish effective strategies that address HAND.

Physical activity provides many significant health benefits, including reducing cardiovascular disease risk and slowing cognitive decline in conditions such as stroke and Alzheimer's disease (Colcombe & Kramer, 2003). The mechanisms mediating beneficial physical activity effects on neurocognition have not been completely elucidated but may involve neurogenesis, improved cerebral blood flow, and reduced inflammation (Lista & Sorrentino, 2010). Aerobic exercise in particular is associated with improvement in multiple cognitive domains, including attention, memory, and executive function (Colcombe & Kramer, 2003). Early proposals have suggested that intense vigorous physical activity might be necessary to induce appreciable cognitive benefits, but recent low/moderate intensity walking interventions have demonstrated that relatively modest physical activity changes can improve cognitive performance in HIV-uninfected impaired populations (Kemoun et al., 2010). For example, increasing physical activity by as little as 500 steps per day improves performance in older adults on measures such as the Trail Making Test B (Rosenberg et al., 2012). A recent cross-sectional study indicated that PLWH with neurocognitive impairment ($n = 43$) exhibited significantly less moderate physical activity (weekly minutes of moderate-intensity physical activity reported on the International Physical Activity Questionnaire) compared to cognitively intact PLWH ($n = 57$; Fazeli et al., 2015); however, the effect of a physical activity intervention on HAND has not been assessed. In addition, physical activity interventions applied in the HIV population have typically required rigorous activity (e.g., running on a treadmill; O'Brien, Nixon, Tynan, & Glazier, 2010) and significant participant effort (traveling to a gym several times a week), which may not be feasible for many individuals.

Over the past few years, a dramatic increase in mobile phone use has expedited the application of

mobile health (mHealth) interventions that effectively reduce smoking, promote weight loss, and stimulate physical activity in a variety of HIV-uninfected populations, including increasing moderate physical activity such as walking (Fjeldsoe, Marshall, & Miller, 2009). Other studies have illustrated that text message interventions can be effectively used to improve everyday function and goal-directed behavior in cognitively impaired populations such as patients with schizophrenia (Pijnenborg et al., 2010). Although Short Message Service (SMS) protocols have not been used to motivate physical activity in PLWH, text message reminders have been demonstrated to improve HIV medication adherence in several studies (Dowshen, Kuhns, Johnson, Holoyda, & Garofalo, 2012; Moore et al., 2013). Recent focus group data suggest that barriers limiting antiretroviral treatment (ART) adherence may also apply to physical activity (e.g., poor motivation, depression); common facilitators (e.g., social support) could also sustain both behaviors (Montoya et al., 2014). Successful physical activity interventions that address these issues have been reported to incorporate self-monitoring, goal-setting, methods to overcome physical activity barriers, and approaches tailored to each participant (Fjeldsoe et al., 2009).

We are currently conducting an ongoing randomized controlled trial (RCT) evaluating iSTEP, a 16-week personalized, interactive Short Message Service/Multimedia Message Service (SMS/MMS) intervention designed to increase moderate physical activity and improve neurocognitive function in persons with HAND. The study has two primary aims: (a) to determine if iSTEP could significantly increase physical activity quantified by objective measures, such as pedometer and accelerometer counts; and (b) to evaluate the effect of iSTEP on a global indicator of neurocognitive performance and measures of everyday function. Here we report on the feasibility and participant acceptance of the iSTEP protocol used to monitor and motivate physical activity in a cognitively impaired population of people with HIV infection. Our objectives were to: (a) report participant preferences for personalized SMS/MMS options, (b) examine the responses to text messages and efficacy of data collection during the intervention, and (c) review qualitative feedback provided by iSTEP and

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